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INT CL<sup>5</sup> A23B , A23L

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(54) An egg processing system

(57) At a loading station raw eggs are transferred from trays onto a conveyor which delivers the eggs to a breaking machine. Each egg is broken and the egg white is separated from the egg yolk. The egg white and egg yolk are delivered to collecting baths either separately or together and then pumped through filters to holding tanks. The raw egg material is then passed through a pasteurising plant comprising a preheater where it is indirectly heated by pasteurised egg and a main heater where it is heated to a desired pasteurising temperature and held at the pasteurising temperature for a preset desirable time period. Pasteurised egg material is then cooled and delivered to a storage tank from which it is pumped into sterilised containers. Preferably before delivery of raw egg material through the pasteurising plant, water is circulated through the pasteurising plant and the pasteurising plant is brought to a desirable operating condition for pasteurising the raw egg material.

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

This print takes account of replacement documents submitted after the date of filing to enable the application to comply with the formal requirements of the Patents Rules 1990.

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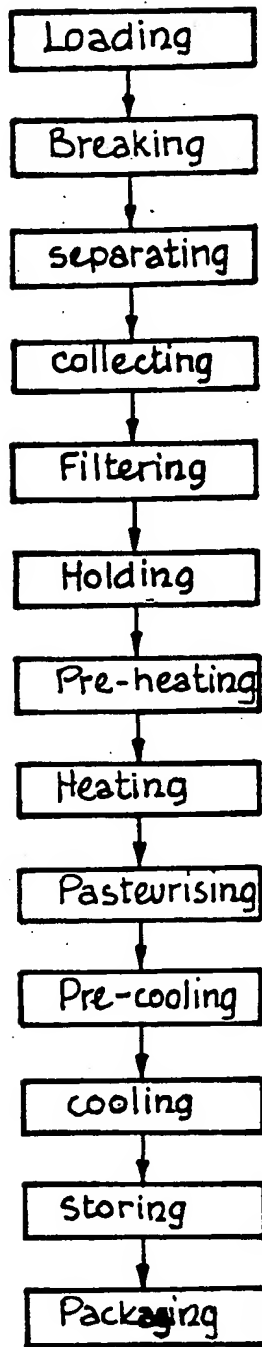


Fig.1

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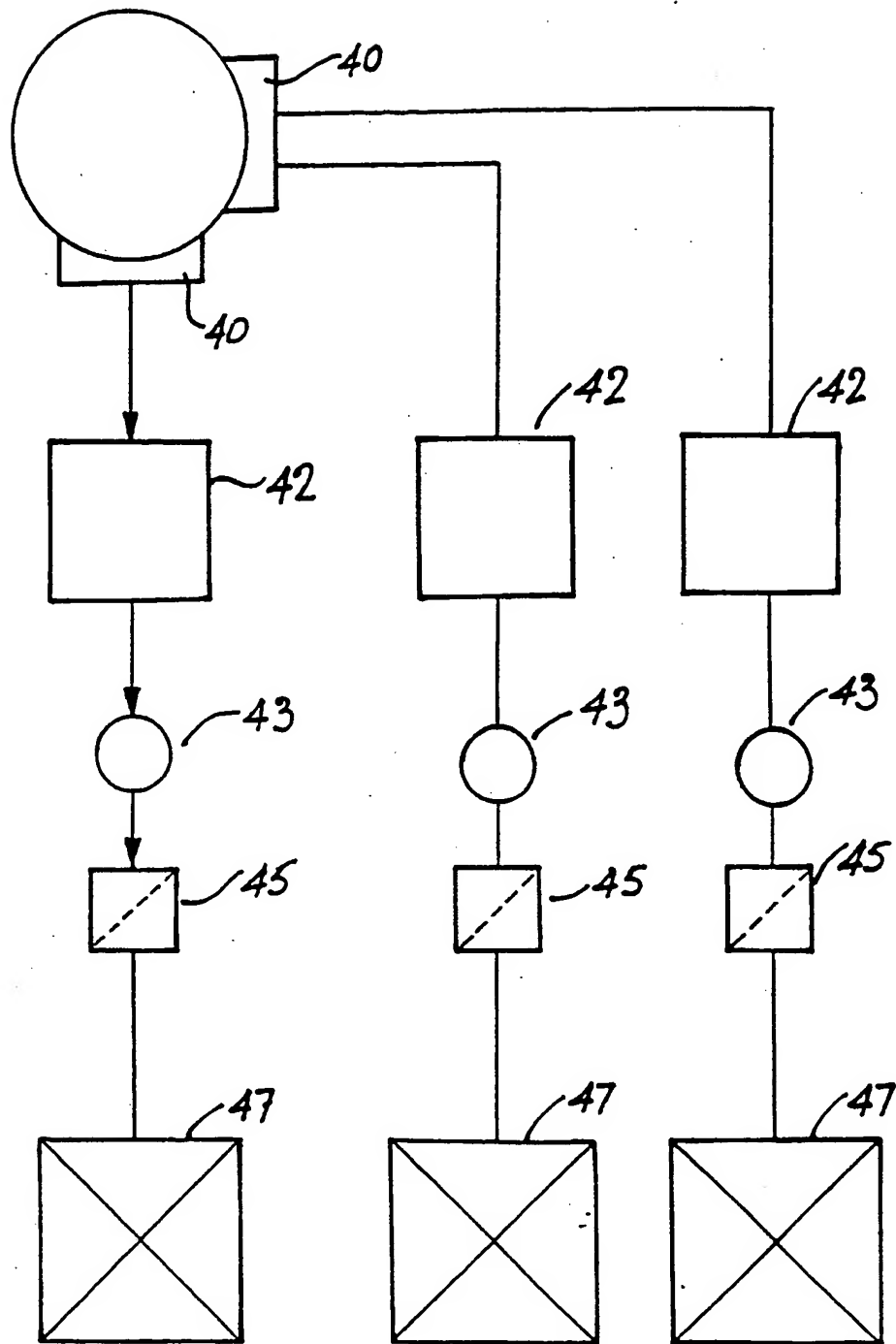


Fig. 2

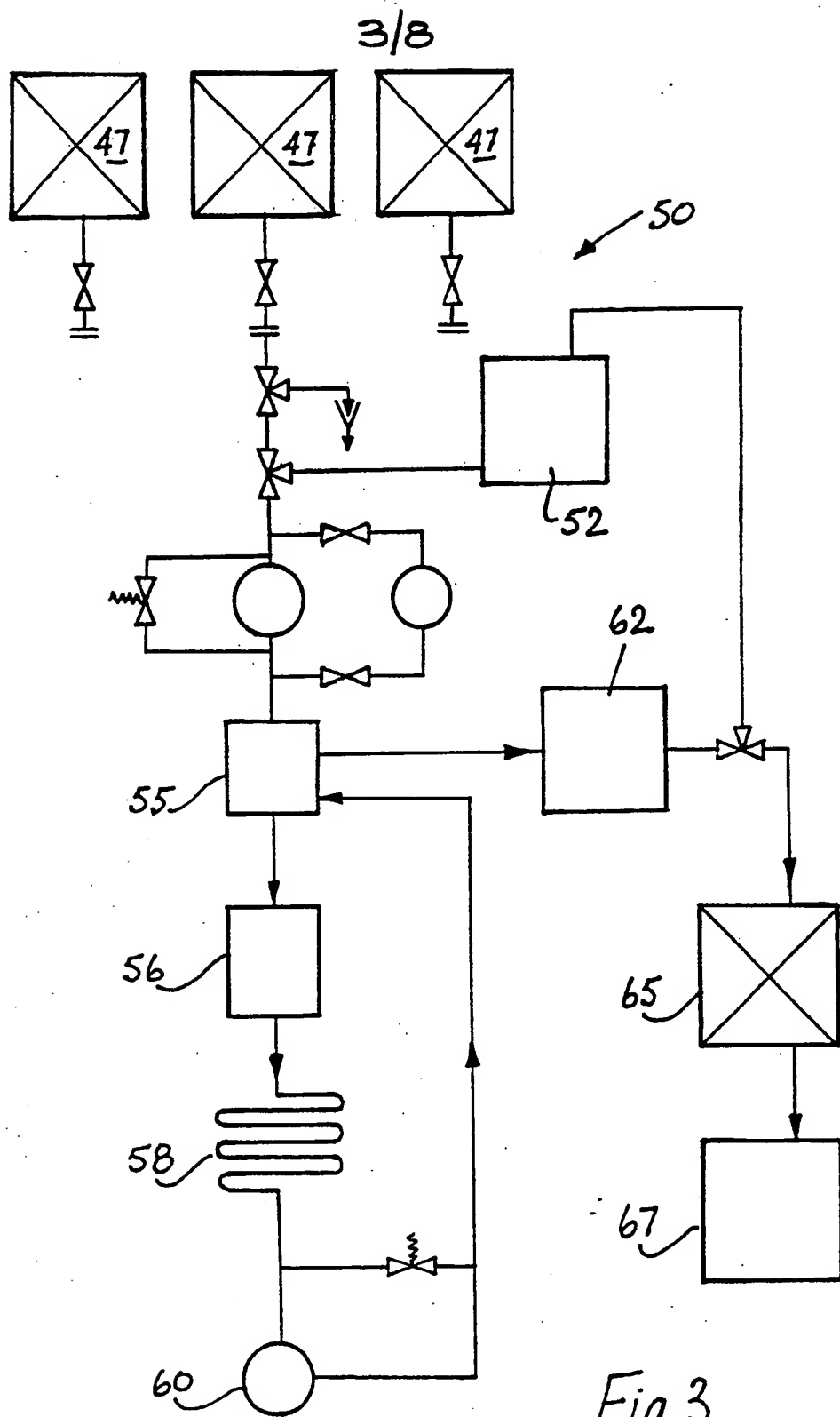


Fig.3

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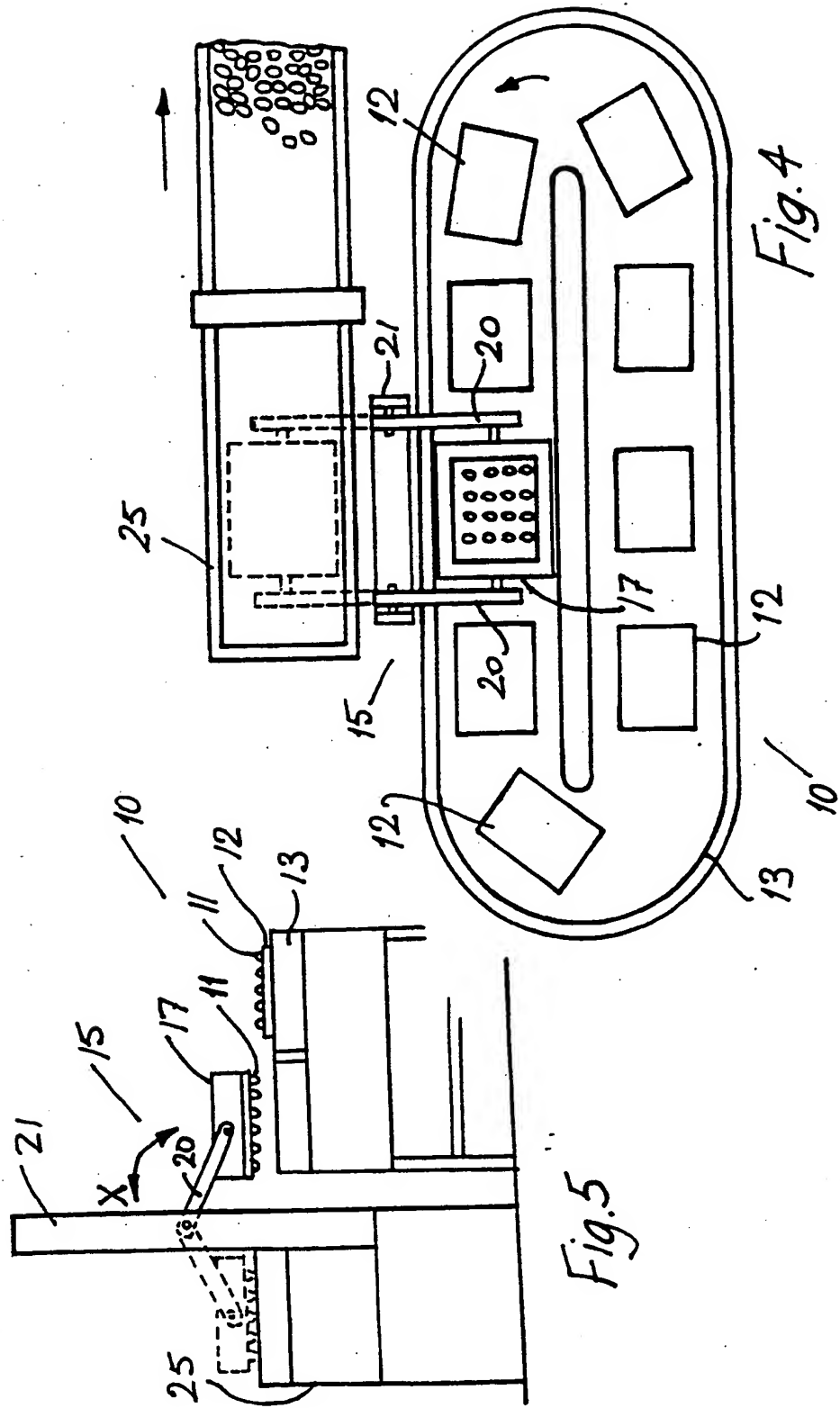


Fig. 4

Fig. 5

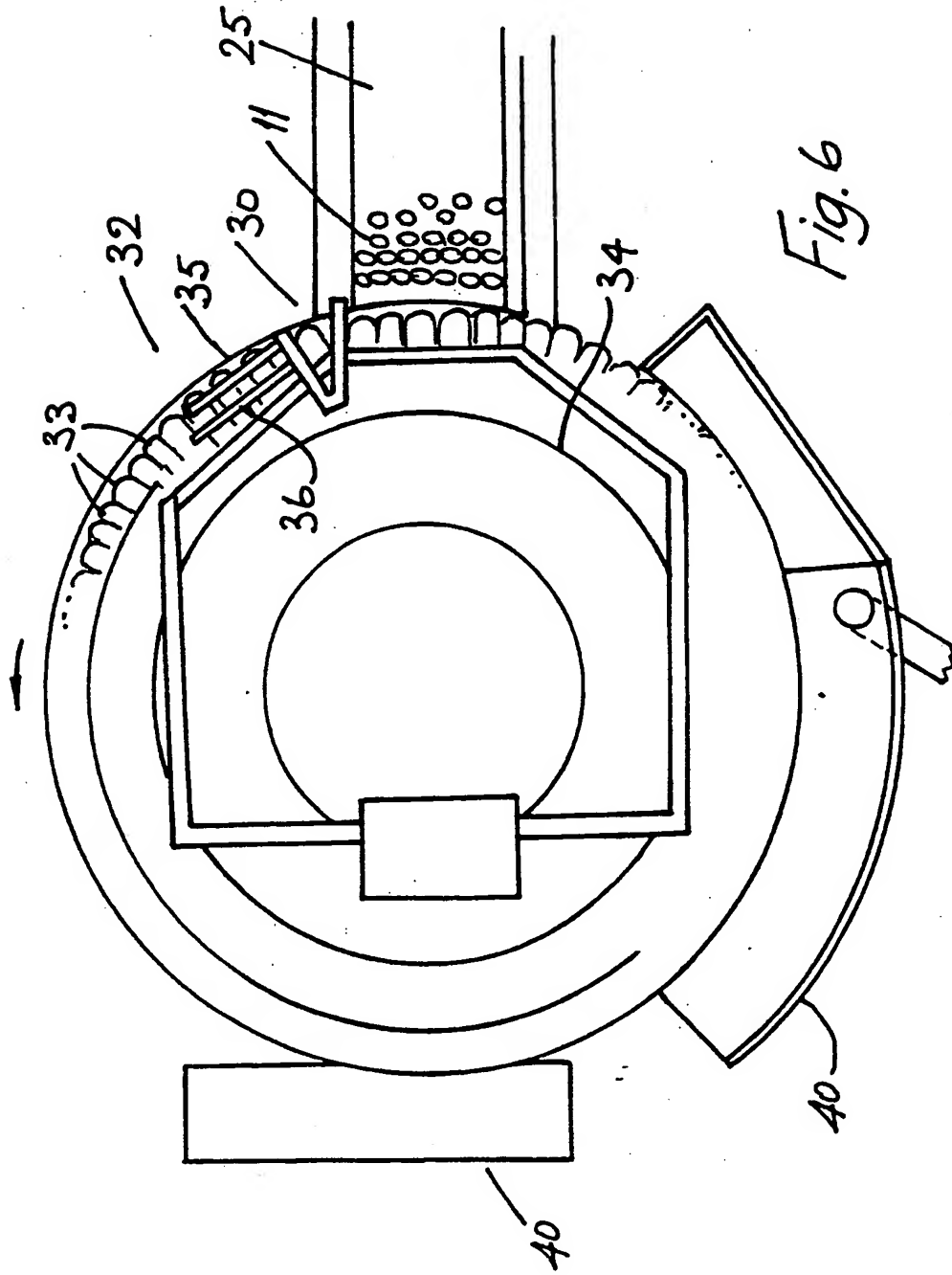
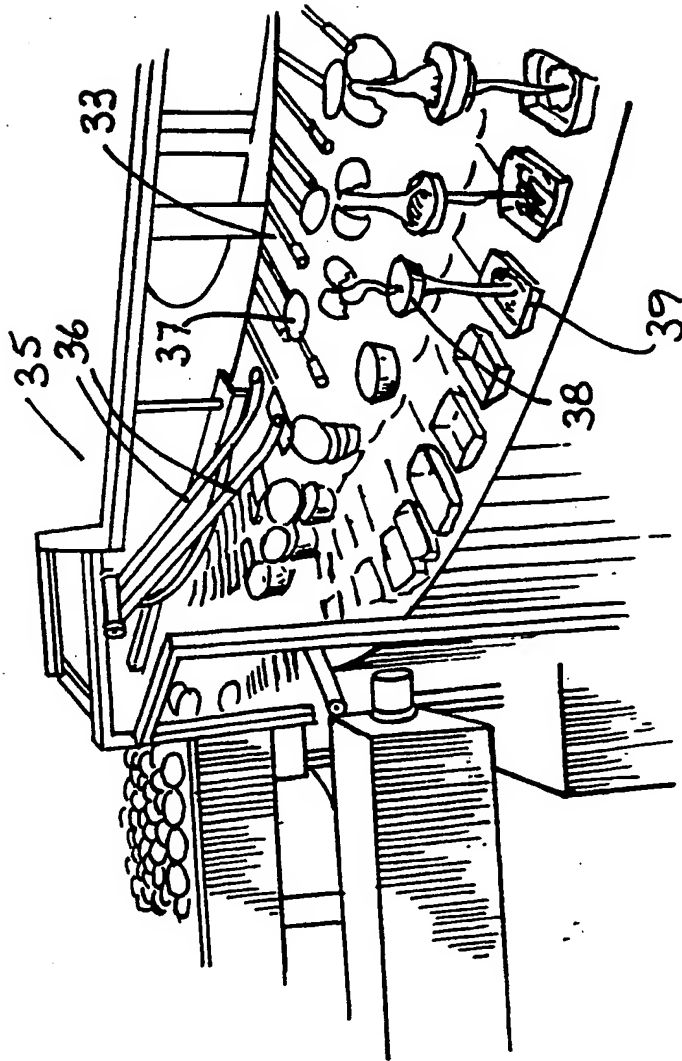


Fig. 7



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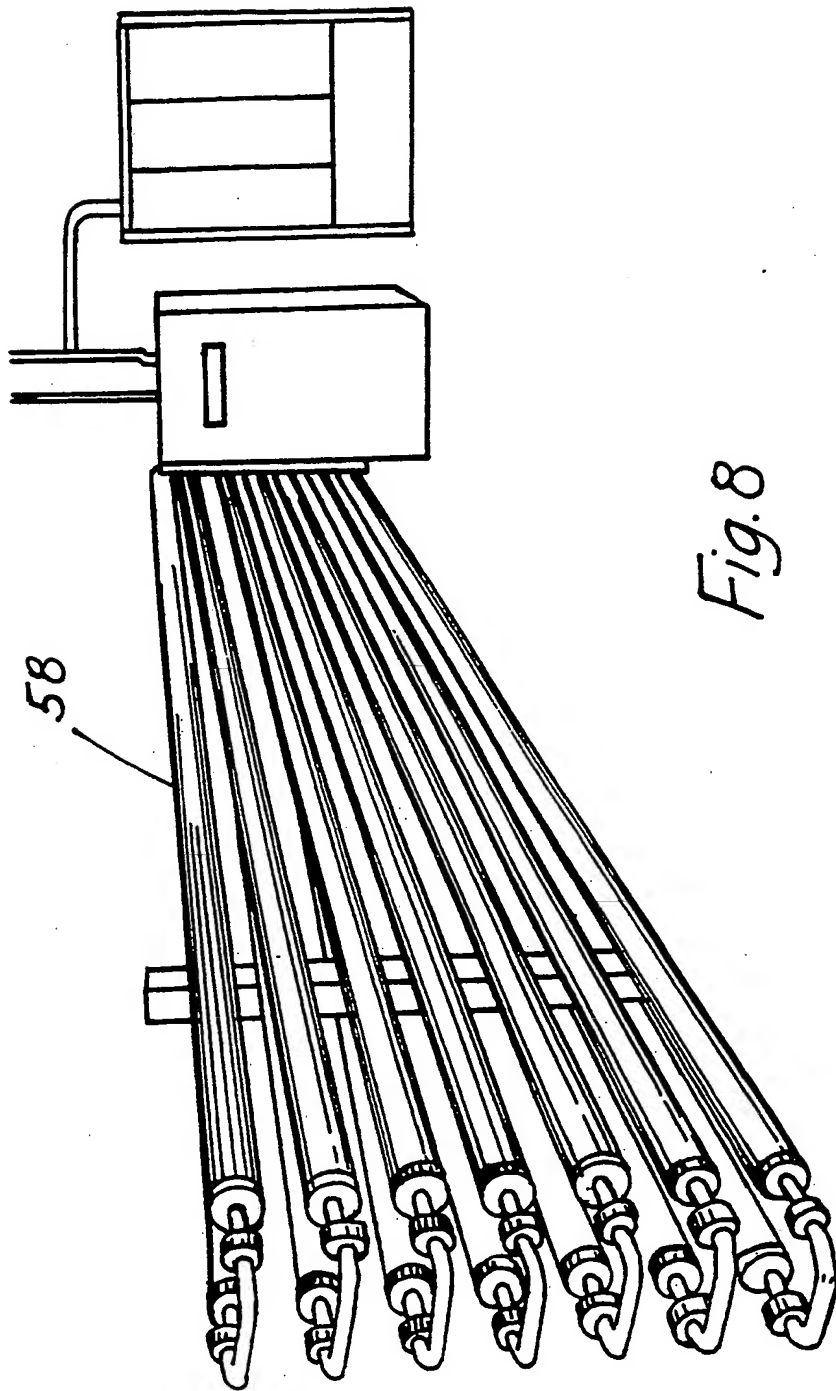
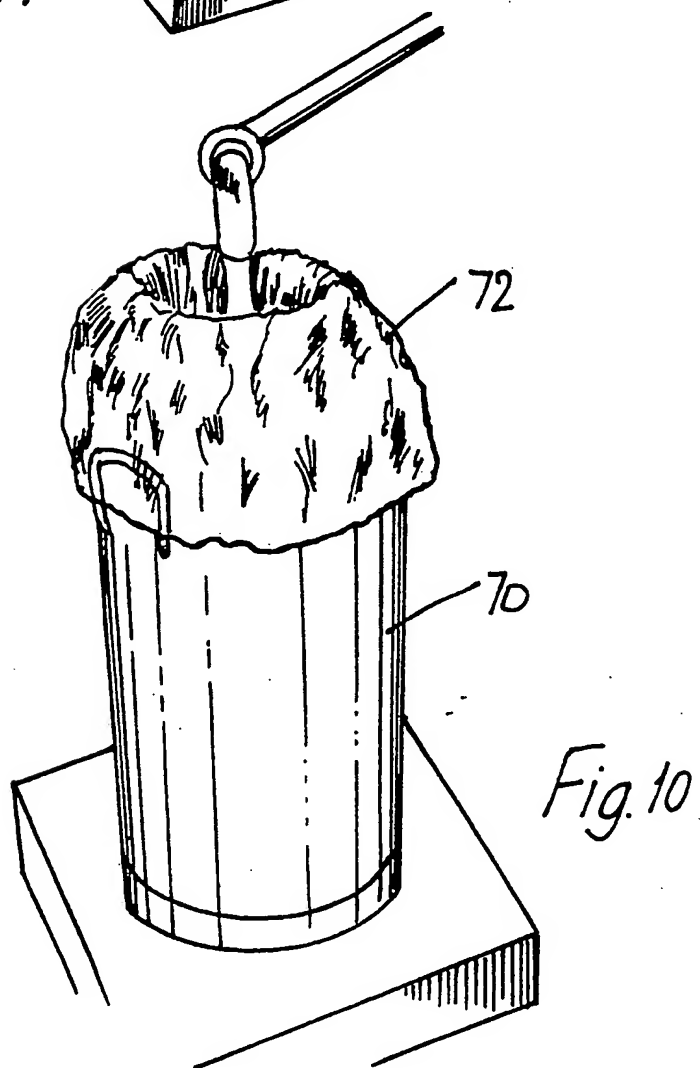
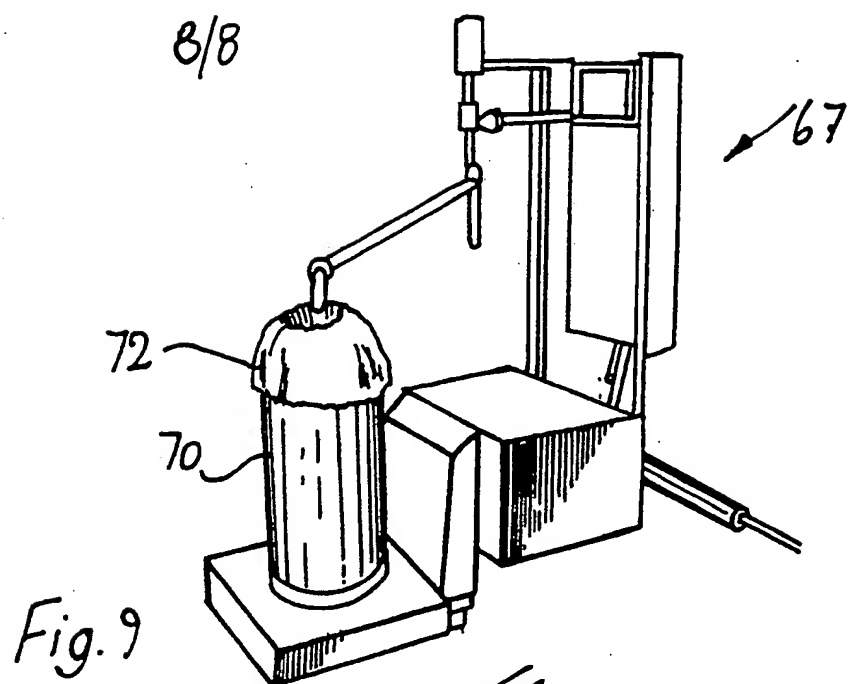


Fig. 8

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"An Egg Processing System"

This invention relates to an egg processing system.

According to the invention there is provided an egg processing system including the steps:

- 5 mounting trays of eggs on an endless conveyor at a loading station;
- moving each tray on the conveyor to an unloading station;
- engaging and gripping each egg on the tray simultaneously at the unloading station;
- 10 lifting the eggs off the tray and carrying the eggs to a feed conveyor;
- releasing the eggs onto the feed conveyor;
- arranging the eggs in rows on the feed conveyor;
- 15 delivering the eggs on the feed conveyor to an inlet of an egg breaking machine;
- successively transferring rows of eggs from the feed conveyor onto the egg breaking machine, each egg being supported on an egg holder on the egg breaking machine;
- 20 moving each egg holder to an egg breaking station, breaking the egg shell centrally into two parts and separating the two parts;

dropping the liquid egg material from each egg into a sieve;

5

separating the egg yolk from the egg white by catching the egg yolk in the sieve and passing the egg white through the sieve into an associated cup mounted below the sieve;

discharging raw egg material into a raw egg material catchment tray for delivery to a raw egg material collecting bath;

10

passing the raw egg material through a coarse filter in the bath;

15

pumping the raw egg material through a fine filter, filtering the raw egg material and delivering the raw egg material to a raw egg material holding tank;

pumping liquid raw egg material from the holding tank to a pre-heater, passing the raw egg material through the pre-heater to raise the temperature of the raw egg material;

20

passing the raw egg material through a main heater, and raising the temperature of raw egg material in the main heater to a preselected pasteurising temperature;

25

passing the heated raw egg material through an insulated pipe whilst substantially maintaining the egg material at the pasteurising temperature for a preset period to pasteurise the raw egg material;

pumping liquid pasteurised egg material through the pre-heater to cool the pasteurised egg material simultaneously heating raw egg material passing through the pre-heater;

5 delivering the liquid pasteurised egg material through a cooler, cooling the liquid pasteurised egg material to a temperature of 1°C-2°C;

discharging the liquid pasteurised egg material into a storage tank; and

10 measuring preset desirable quantities of liquid pasteurised egg material into sterilised containers and sealing the containers.

In one embodiment of the invention prior to pumping liquid raw egg material from the holding tank the system includes  
15 the steps:

circulating water from a storage tank around an egg material flow path through the pasteurising equipment and returning the water to the storage tank;

20 operating the pasteurising equipment to achieve preset desirable temperature conditions at the heat exchangers corresponding to preset desirable conditions for pasteurising the liquid raw egg material;

25 maintaining said desirable conditions for a preset period;

stopping the circulation of water through the pasteurising equipment;

pumping the raw egg material from the holding tank through the pasteurising equipment displacing the water from the pasteurising equipment;

5 monitoring the condition of the raw egg material as it passes through the pasteurising equipment;

initially discharging displaced water and pasteurised egg material from the cooler to waste until preset desirable pasteurising conditions are achieved and then delivering the pasteurised egg material to the storage tank.

10

In another embodiment the system includes the step of monitoring the back pressure at the heat exchangers to ensure the back pressure is maintained within preset limits;

15 generating an alarm if the back pressure reaches a preset maximum limit;

stopping the supply of raw egg material to the pasteurising equipment if the back pressure reaches the maximum preset limit;

20 circulating a cleaning fluid through the pasteurising equipment to clean the egg flow path through the pasteurising equipment; and

bringing the pasteurising equipment into a pasteurising condition and then circulating liquid raw egg material through the pasteurising equipment.

25

In a further embodiment the system includes the step of packing the pasteurised egg product by:

sterilising a container for a reception of pasteurised liquid egg material;

5 mounting a sterile plastics bag within the container to line the container;

delivering a measured quantity of pasteurised egg material from the storage tank into the plastics bag within the container;

10 sealing the plastics bag and then sealing the container.

The invention will be more clearly understood by the following description of an embodiment thereof, given by way of example only, with reference to the accompanying  
15 drawings, in which :

Fig. 1 is a schematic illustration of an egg processing system according to the invention;

Fig. 2 is a schematic illustration of egg processing equipment used in the system;

20 Fig. 3 is a schematic illustration of further egg processing equipment used in the system;

Fig. 4 is a plan view of portion of the equipment;

Fig. 5 is an end elevational view of the equipment shown in Fig. 4;

Fig. 6 is a diagrammatic plan view of an egg breaking machine used in the system;

Fig. 7 is a detail diagrammatic perspective view of portion of the egg breaking machine;

5        Fig. 8 is a perspective view of portion of the equipment;

Fig. 9 is a perspective view of packaging equipment used in the system; and

10       Fig. 10 is an enlarged detail perspective view of portion of the packaging equipment.

Referring to the drawings an egg processing system and apparatus according to the invention will be described. At a loading station 10 raw eggs 11 on trays 12 are mounted on an endless conveyor 13. Each tray 12 is moved  
15       on the conveyor 10 to an unloading station 15. At the unloading station 15 the eggs 11 are engaged and gripped by a gripper 17 having a plurality of spaced-apart suction heads. Each suction head engages a top of an egg 11 and with vacuum applied to the suction head each egg 11 is  
20       securely gripped. Thus each egg on the tray 12 is securely gripped simultaneously. Once gripped, the eggs 11 are lifted off the tray 12 by the gripper 17 and the empty tray 12 passes around the conveyor 13 and is removed at the loading station 10.

25       The gripper 17 is pivotally mounted between a pair of spaced-apart carrier arms 20 which are pivotally mounted on a support frame 21 for pivoting about a substantially horizontal axis. The arms 20 are operable to pivot in the direction of arrow X of Fig. 5 to carry the eggs to a feed  
30       conveyor 25. When the eggs 11 are positioned just above

the feed conveyor 25, as indicated in phantom outline in Fig. 5, the vacuum to the gripper 17 is released dropping the eggs onto the feed conveyor 25.

5 As the eggs are carried along on the feed conveyor 25 guides (not shown) arrange the eggs in rows of spaced-apart eggs on the feed conveyor 25. The feed conveyor 25 delivers the eggs 11 in formation to an inlet 30 of an egg breaking machine 32. (see Fig. 6).

10 At the inlet 30 of the egg breaking machine 32 each row of eggs 11 is successively transferred from the feed conveyor 25 on to the egg breaking machine 32. The egg breaking machine 32 has a number of egg holders 33 arranged side by side around the circumference of a rotatable support 34. Each egg 11 is delivered to one of the egg holders 33.  
15 Downstream of the inlet 30 is an egg breaking station 35 at which an inclined pusher arm 36 pushes a hammer 37 associated with each egg holder 33 downwardly to break each egg shell. It will be noted that each egg shell is broken centrally into two parts which are then separated  
20 on the holder 33 as shown in Fig. 7. Liquid egg material from each egg is dropped into a sieve 38 located beneath and associated with each holder 33. The egg yolk is separated from the egg white by catching the egg yolk in the sieve 38 and allowing the egg white to pass through  
25 the sieve 38 into an associated cup 39 mounted below the sieve 38.

Both the sieve 38 and the cup 39 are pivotally mounted on the holder support 34 and downstream of the breaking station 35 each sieve 38 and each holder 39 can be tilted  
30 to discharge its contents into a raw egg material catchment tray 40. Two raw egg material catchment trays 40 are provided, thus the egg yolk and egg white can be discharged together into one catchment tray 40 or the egg

yolk and egg white can be discharged into separate catchment trays 40 if desired.

From each catchment tray 40 raw egg material is delivered to a raw egg material collecting bath 42. Within the bath  
5 42 the raw egg material is passed through a course filter to catch any large egg shell pieces which may be entrained with the raw egg material. The raw egg material is pumped by means of a pump 43 through a fine filter 45 which  
10 filters the raw egg material to remove any smaller egg shell pieces. Each pump 43 is operable in response to high and low level sensors 44 located in each bath 42. Downstream of the fine filter 45 the raw egg material is delivered to a raw egg material holding tank 47.

Pasteurising equipment 50 for the raw egg material is  
15 shown in Fig. 3. Water from a water storage tank 52 is circulated through the pasteurising equipment 50 whilst operating the pasteurising equipment 50 to bring the pasteurising equipment 50 into a suitable condition for pasteurising the raw egg material. Then the raw egg  
20 material is delivered from the holding tank 47 through the pasteurising equipment 50. From the holding tank 47 the raw egg material passes through a pre-heater 55. Within the pre-heater 55 the temperature of the raw egg material is raised to approximately 58°C. Next the raw egg material  
25 passes through a main heater 56 in which the temperature of the raw egg material is raised to a desired pasteurising temperature, in this case approximately 64.8°C. The heated raw egg material is then passed through an insulated pipe 58 whilst maintaining the temperature at  
30 the pasteurising temperature. The length of the pipe 58 is such that the passage time of the egg material through the pipe 58 is 4.9 minutes. Advantageously the length of the pipe 58 can be adjusted to adjust the passage time.

At an outlet of the pipe 58 the temperature of the pasteurised egg material will be approximately 64.4°C.

Downstream of the pipe 58 a pump 60 delivers the pasteurised egg material back through the pre-heater 55 to  
5 pre-cool the pasteurised egg material, simultaneously heating raw egg material passing through the pre-heater 55. Downstream of the pre-heater 55 the pasteurised egg material is passed through a cooler 62 in which the  
10 pasteurised egg material is cooled to a temperature in the region of 1°C. Pasteurised egg material discharged from the cooler 62 is delivered to a pasteurised egg material storage tank 65.

From the storage tank 65 the pasteurised egg material is delivered to a packing station 67 at which preset  
15 desirable quantities of the pasteurised egg material is delivered into sterilised containers. In this case the sterilised containers comprise sterilised churns 70. A sterile plastics bag 72 is mounted within each churn 70 for reception of the pasteurised egg material. A pre-  
20 desired weight of pasteurised egg material is delivered into each churn 70. Then the bag 72 is sealed and finally the churn 70 is closed.

It will be noted that the pasteurising temperature for egg white will be somewhat lower than the pasteurising  
25 temperature given above which is suitable for whole egg or for egg yolk. In the case of egg white, the pasteurising temperature would be approximately 57°C. Further, for processing egg white, the pipe 58 is shortened such that the passage time of the egg white through the pipe 58 is  
30 approximately 3.5 minutes.

It will be noted that pressure sensors (not shown) are provided to measure the flow resistance of the heat

exchangers 55, 56. Should this back pressure exceed a preset limit, an alarm sounds and the pumps are switched off. With the raw material holding tank 47 isolated, the material within the pasteurising equipment 50 can be  
5 evacuated and the pasteurising equipment 50 cleaned prior to re-using the pasteurising equipment 50. Pressure relief valves allow recirculation of material from an outlet to an inlet of each pump if the pressure downstream of each pump exceeds a preset limit to prevent damage to  
10 the heat exchangers 55, 56 which are plate type heat exchangers.

The invention is not limited to the embodiment hereinbefore described which may be varied in both construction and detail.

CLAIMS

1. An egg processing system including the steps :

mounting trays of eggs on an endless conveyor  
at a loading station;

5 moving each tray on the conveyor to an  
unloading station;

engaging and gripping each egg on the tray  
simultaneously at the unloading station;

10 lifting the eggs off the tray and carrying  
the eggs to a feed conveyor;

releasing the eggs onto the feed conveyor;

arranging the eggs in rows on the feed  
conveyor;

15 delivering the eggs on the feed conveyor to  
an inlet of an egg breaking machine;

successively transferring rows of eggs from  
the feed conveyor onto the egg breaking  
machine, each egg being supported on an egg  
holder on the egg breaking machine;

20 moving each egg holder to an egg breaking  
station, breaking the egg shell centrally  
into two parts and separating the two parts;

dropping the liquid egg material from each  
egg into a sieve;

separating the egg yolk from the egg white by catching the egg yolk in the sieve and passing the egg white through the sieve into an associated cup mounted below the sieve;

5                   discharging raw egg material into a raw egg material catchment tray for delivery to a raw egg material collecting bath;

passing the raw egg material through a coarse filter in the bath;

10                  pumping the raw egg material through a fine filter, filtering the raw egg material and delivering the raw egg material to a raw egg material holding tank;

15                  pumping liquid raw egg material from the holding tank to a pre-heater, passing the raw egg material through the pre-heater to raise the temperature of the raw egg material;

20                  passing the raw egg material through a main heater, and raising the temperature of raw egg material in the main heater to a preselected pasteurising temperature;

25                  passing the heated raw egg material through an insulated pipe whilst substantially maintaining the egg material at the pasteurising temperature for a preset period to pasteurise the raw egg material;

pumping liquid pasteurised egg material through the pre-heater to cool the pasteurised egg material simultaneously

heating raw egg material passing through the pre-heater;

5 delivering the liquid pasteurised egg material through a cooler, cooling the liquid pasteurised egg material to a temperature of 1°C-2°C;

discharging the liquid pasteurised egg material into a storage tank; and

10 measuring preset desirable quantities of liquid pasteurised egg material into sterilised containers and sealing the containers.

2. 15 A system as claimed in Claim 1 wherein prior to pumping liquid raw egg material from the holding tank the system includes the steps:

circulating water from a storage tank around an egg material flow path through the pasteurising equipment and returning the water to the storage tank;

20 operating the pasteurising equipment to achieve preset desirable temperature conditions at the heat exchangers corresponding to preset desirable conditions for pasteurising the liquid  
25 raw egg material;

maintaining said desirable conditions for a preset period;

stopping the circulation of water through the pasteurising equipment;

5

pumping the raw egg material from the holding tank through the pasteurising equipment displacing the water from the pasteurising equipment;

monitoring the condition of the raw egg material as it passes through the pasteurising equipment;

10

initially discharging displaced water and pasteurised egg material from the cooler to waste until preset desirable pasteurising conditions are achieved and then delivering the pasteurised egg material to the storage tank.

15

3. A system as claimed in Claim 1 or Claim 2 including the step of monitoring the back pressure at the heat exchangers to ensure the back pressure is maintained within preset limits;

20

generating an alarm if the back pressure reaches a preset maximum limit;

stopping the supply of raw egg material to the pasteurising equipment if the back pressure reaches the maximum preset limit;

25

circulating a cleaning fluid through the pasteurising equipment to clean the egg flow path through the pasteurising equipment; and

bringing the pasteurising equipment into a pasteurising condition and then circulating liquid raw egg material through the pasteurising equipment.

- 5      4.      A system as claimed in any preceding claim wherein the system includes the step of packing the pasteurised egg product by:

sterilising a container for a reception of pasteurised liquid egg material;

10                      mounting a sterile plastics bag within the container to line the container;

                         delivering a measured quantity of pasteurised egg material from the storage tank into the plastics bag within the container;

15

                         sealing the plastics bag and then sealing the container.

5.      An egg processing system substantially as hereinbefore described with reference to the accompanying drawings.
- 20

6.      A pasteurised egg product whenever produced by the process as claimed in any preceding claim.

**Patents Act 1977****Examiner's report to the Comptroller under Section 17  
(The Search report)****-16-**Application number  
GB 9321827.9**Relevant Technical Fields**

(i) UK Cl (Ed.M) A2D (DPK, DPL, DX2, DX3) A4D (D14)

(ii) Int Cl (Ed.5) A23B; A23L

Search Examiner  
K MacDonaldDate of completion of Search  
21 February 1994**Databases (see below)**

(i) UK Patent Office collections of GB, EP, WO and US patent specifications.

(ii) ONLINE DATABASES : WPI

Documents considered relevant  
following a search in respect of  
Claims :-  
1-6**Categories of documents**

- X: Document indicating lack of novelty or of inventive step. P: Document published on or after the declared priority date but before the filing date of the present application.
- Y: Document indicating lack of inventive step if combined with one or more other documents of the same category. E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.
- A: Document indicating technological background and/or state of the art. &: Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages	Relevant to claim(s)
A	WPI Abstract Accession No 93-234174/29 and SU 1750602 A1 (KOMPLEKS etc) 30 July 1992 (see abstract)	

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